

1      **CLAIMS**

2      1. A method comprising:

3            receiving a transport stream containing video data and audio data;

4            determining a time required to process the video data contained in the  
5            transport stream;

6            determining a time required to process the audio data contained in the  
7            transport stream;

8            determining a difference in time to process the video data contained in the  
9            transport stream as compared to the audio data contained in the transport stream;

10          and

11            delaying presentation of the audio data by the difference in time to process  
12            the video data contained in the transport stream as compared to the audio data  
13            contained in the transport stream.

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15          2. A method as recited in claim 1, wherein delaying presentation of the  
16            audio data by the difference in time to process the video data contained in the  
17            transport stream as compared to the audio data contained in the transport stream is  
18            performed if the difference in time exceeds a threshold.

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20          3. A method as recited in claim 1, wherein determining a time required  
21            to process the video data contained in the transport stream includes receiving a  
22            video presentation delay from a video display software routine.

1       4. A method as recited in claim 1, wherein determining a time required  
2 to process the video data contained in the transport stream includes calculating a  
3 video presentation delay by comparing a presentation time stamp and a system  
4 time clock.

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6       5. A method as recited in claim 1, wherein the method of claim 1 is  
7 repeated at periodic intervals.

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9       6. A method as recited in claim 1, wherein the method of claim 1 is  
10 performed for each received frame of video data.

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12      7. A method as recited in claim 1, wherein delaying presentation of the  
13 audio data by the difference in time to process the video data contained in the  
14 transport stream as compared to the audio data contained in the transport stream  
15 includes storing the audio data in a DMA buffer with a delay that corresponds to  
16 the difference in time to process the video data contained in the transport stream as  
17 compared to the audio data contained in the transport stream.

18  
19      8. A method as recited in claim 1, further comprising decoding the video  
20 data received in the transport stream.

21  
22      9. A method as recited in claim 1, further comprising decoding the audio  
23 data received in the transport stream.

1       **10.** A method comprising:

2           receiving a transport stream containing video data and audio data;

3           determining a time required to process the video data contained in the  
4 transport stream;

5           determining a time required to process the audio data contained in the  
6 transport stream;

7           determining a difference in time to process the video data contained in the  
8 transport stream as compared to the audio data contained in the transport stream;

9           if the time required to process the video data is greater than the time  
10 required to process the audio data, delaying presentation of the audio data by the  
11 difference in time to process the video data contained in the transport stream as  
12 compared to the audio data contained in the transport stream; and

13           if the time required to process the audio data is greater than the time  
14 required to process the video data, delaying presentation of the video data by the  
15 difference in time to process the video data contained in the transport stream as  
16 compared to the audio data contained in the transport stream.

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18       **11.** A method as recited in claim 10, wherein determining a time

19 required to process the video data contained in the transport stream includes  
20 receiving a video presentation delay.

1           **12.** A method as recited in claim 10, wherein determining a time  
2 required to process the video data contained in the transport stream includes  
3 calculating a video presentation delay by comparing a presentation time stamp and  
4 a system time clock.

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6           **13.** A method as recited in claim 10, further comprising decoding the  
7 video data received in the transport stream.

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9           **14.** A method as recited in claim 10, further comprising decoding the  
10 audio data received in the transport stream.

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12           **15.** A method comprising:  
13           receiving a transport stream containing video data and audio data;  
14           identifying a presentation time stamp in the transport stream;  
15           identifying a value associated with a system time clock;  
16           determining a time required to process the video data contained in the  
17 transport stream by comparing the presentation time stamp and the system time  
18 clock; and  
19           delaying presentation of the audio data by the time required to process the  
20 video data contained in the transport stream.

1       **16.** A method as recited in claim 15, wherein delaying presentation of  
2 the audio data by the time required to process the video data contained in the  
3 transport stream is performed if the time required to process the video data  
4 contained in the transport stream exceeds a threshold.

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6       **17.** A method as recited in claim 15, wherein delaying presentation of  
7 the audio data by the time required to process the video data contained in the  
8 transport stream includes storing the audio data in a buffer with a delay that  
9 corresponds to the time required to process the video data contained in the  
10 transport stream.

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12       **18.** A method as recited in claim 15, wherein delaying presentation of  
13 the audio data by the time required to process the video data contained in the  
14 transport stream includes:

15              determining a position of a DMA read pointer; and

16              storing the audio data in a DMA buffer with a delay that matches the time  
17 required to process the video data contained in the transport stream.

18

19       **19.** A method as recited in claim 15, further comprising decoding the  
20 received video data.

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22       **20.** A method as recited in claim 15, further comprising decoding the  
23 received audio data.

1           **21.** An apparatus comprising:

2           a transport stream decoder coupled to receive a transport stream and  
3        configured to separate audio data and video data from the transport stream;

4           a video processing module configured to receive video data from the  
5        transport stream decoder;

6           an audio processing module configured to receive audio data from the  
7        transport stream decoder; and

8           a clock control module coupled to the transport stream decoder to receive  
9        timing data from the transport stream, the clock control module further coupled to  
10       the video processing module and the audio processing module and further  
11       configured to delay presentation of the audio data by a difference in time to  
12       process the video data as compared to the audio data.

13

14           **22.** An apparatus as recited in claim 21, wherein the audio processing  
15        module delays presentation of the audio data by storing the audio data in a buffer  
16        with a delay that corresponds to the difference in time to process the video data as  
17        compared to the audio data.

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19           **23.** An apparatus as recited in claim 21, wherein the transport stream  
20        decoder is further configured to decode the video data and the audio data contained  
21        in the transport stream.

1       **24.** An apparatus as recited in claim 21, wherein the transport stream  
2 decoder is further configured to decode the video data and the audio data contained  
3 in the transport stream as well as timing information contained in the transport  
4 stream.

5  
6       **25.** An apparatus comprising:

7              a system time clock coupled configured to maintain a current system;  
8              a video display software routine executing on a processor and configured to  
9 receive a first time stamp from a transport stream and receive a current system time  
10 from the system time clock, the video display software routine further configured  
11 to determine a video presentation delay based on the first time stamp and the  
12 current system time; and

13              an audio software routine executing on the processor and configured to  
14 receive the video presentation delay from the video display software routine and  
15 delay presentation of audio data contained in the transport stream based on the  
16 video presentation delay.

17  
18       **26.** An apparatus as recited in claim 25, wherein the audio software  
19 routine delays presentation of audio data contained in the transport stream by  
20 storing the audio data in a buffer with a delay that corresponds to the video  
21 presentation delay.

1       **27.** An apparatus as recited in claim 26, further comprising audio  
2 reproduction hardware configured to retrieve audio data stored in the buffer and  
3 generate an audio analog signal associated with the audio data.

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5       **28.** An apparatus as recited in claim 25, wherein the video display  
6 software routine determines the video presentation delay each time a vertical  
7 retrace sync signal is received.

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9       **29.** An apparatus as recited in claim 25, wherein the video display  
10 software routine determines the video presentation delay at periodic intervals.

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12      **30.** One or more computer-readable media having stored thereon a  
13 computer program that, when executed by one or more processors, causes the one  
14 or more processors to:

15           receive a transport stream containing video data and audio data;

16           identify a time stamp in the transport stream;

17           determine a current system time;

18           determine a time required to process the video data contained in the  
19 transport stream by comparing the presentation time stamp and the current system  
20 time; and

21           delay presentation of the audio data by the time required to process the  
22 video data contained in the transport stream.

1       **31.** One or more computer-readable media as recited in claim 30,  
2 wherein delaying presentation of the audio data by the time required to process the  
3 video data contained in the transport stream includes storing the audio data in a  
4 buffer with a delay that corresponds to the time required to process the video data  
5 contained in the transport stream.

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7       **32.** One or more computer-readable media as recited in claim 30,  
8 further causing the one or more processors to decode the audio data and decode the  
9 video data.

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